RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK5899 CK6206

SUBMINIATURE SEMI-REMOTE PENTODES

The CK5899 and CK6206 are heater-cathode type semi–remote cut-off RF pentodes of sub–miniature construction capable of operation in the UHF region. Type CK6206 is identical to type CK5899 except for an external suppressor grid connection. These types are characterized by long life and stable performance in service where severe conditions of high temperature, high altitude and mechanical shock or vibration are encountered. The flexible terminal leads may be soldered or welded directly to circuit components without the use of sockets. Standard 8–pin subminiature sockets may be used by cutting the leads to 0.20" length.

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock)	450	G
Fatigue (Vibrational Acceleration for Extended Periods)	2.5	G
Maximum Bulb Temperature	220	°C
Altitude	80,000	Ft.

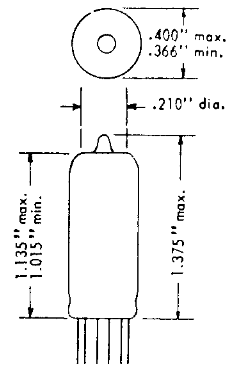
ELECTRICAL DATA

Ratings and Normal Operation	MIL-E-1 Symbol	Test Limit or Absolute Minimum	Normal Operation	Normal Test Conditions	Test Limit or Absolute Maximum	MIL-E-1 Symbol
Ratings						
Heater Voltage	Ef:	6.0	---	6.3	6.6	V
Plate Voltage	Eb:	---	---	100	165	Vdc
Grid Voltage	Ec1:	–55	---	0	0	Vdc
Grid #2 Voltage	Ec2:	---	---	100	155	Vdc
Grid #3 Voltage (Note A)	Ec3:	---	---	0	22	Vdc
Heater-Cathode Voltage	Ehk:	---	---	0	200	v
Cathode Resistance	Rk:	---	---	120	---	ohms
Grid Resistance	Rg1:	---	---	---	1.1	Meg
Cathode Current	Ik:	---	---	---	16.5	mAdc
Plate Dissipation	Pp:	---	---	---	0.85*	W
Grid #2 Dissipation	Pg2:	---	---	---	0.25*	W
*Design Maximum						
Tests						
Plate Current (1)	Ib:	5.2	7.2	---	9.2	mAdc
Grid #2 Current	Ic2:	1.0	---	---	3.0	mAdc
Heater Current	If:	140	150	---	160	mA
Transconductance (1)	Gm:	3800	4500	---	5200	µmhos
Heater Cathode Leakage, Ehk = ± 100 Vdc	Ihk:	---	---	---	5.0	µAdc
Vibration (2) Low frequency F = 40 cps; G = 15; Rp = 10,000; Ck = 1000 µf	E_p	---	---	---	60	mVac

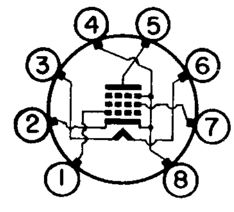
MECHANICAL DATA

ENVELOPE T-3
OUTLINE . . . . JEDEC (3-1)
BASE . . . . . E8-10 Subminiature Button (0.017" tinned flexible leads. Length: 1.5" min.)
CATHODE . . . . . Coated Unipotential
MOUNTING POSITION . . . . Any

PHYSICAL DIMENSIONS



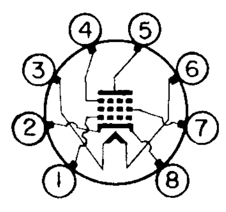
BASING–CK5899



TERMINAL CONNECTIONS: –8DL

Lead 1 Grid #1
Lead 2 Cathode and Grid #3
Lead 3 Heater
Lead 4 Cathode and Grid #3
Lead 5 Plate
Lead 6 Heater
Lead 7 Grid #2
Lead 8 Cathode and Grid #3

BASING–CK6206



TERMINAL CONNECTIONS: – 8DC

Lead 1 Grid #1
Lead 2 Cathode and Shield
Lead 3 Heater
Lead 4 Grid #3
Lead 5 Plate
Lead 6 Heater
Lead 7 Grid #2
Lead 8 Cathode and Shield

Printed in U.S.A.

Ratings and Normal Operation:	MIL-E-1 Symbol	Test Limit or Absolute Minimum	Normal Operation	Normal Test Conditions	Test Limit or Absolute Maximum	MIL-E-1 Symbol
			Tests (Continued)			
Transconductance (2) Ef = 5.7 V	Δ_{Ef}Gm:	---	---	---	10	%
Transconductance (3)	Gm:	1.0	25	---	75	μmhos
Plate Resistance	rp:	0.175	---	---	---	Meg
Interelectrode Capacitance 0.405 in. dia. shield	Cg1p:	---	---	---	0.015	pf
	Cin:	3.5	---	---	4.5	pf
	Cout:	2.9	---	---	3.9	pf

SPECIAL TESTS AND RATINGS TO INSURE RELIABILITY.

Randomly selected statistical samples are subjected to the following tests:

Shock Test – 450G. 30° hammer angle in Navy high impact shock machine. Sample subjected to twenty impact accelerations, five impact accelerations in each of four different positions.

Fatigue Test – 2.5G. Sample subjected to vibrational acceleration of 2.5G for 96 hours (32 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Glass Strain – A sample is subjected to a forty eight hour holding period at room temperature. The sample is immersed in water at 97 – 100°C for 15 seconds and immediately immersed in water at not more than 5°C. The sample is then dried at room temperature for 48 hours and inspected for evidence of air leaks.

Heater–Cycling Life Test – A sample is subjected to 2000 on–off heater cycles at the following conditions. Ef = 7.0 V; Ehk = 140 Vac and other elements floating. At the conclusion of this test the tubes will not show open heater or cathode circuits, or heater to cathode shorts.

Stability Life Test – Sample is operated for one hour to assure initial electrical stability (Δ_t Sm < 10%). Ehk = + 200 Vdc; Rg1 = 1.0 Meg; TA = room.

Survival Rate Life Test – Sample is operated one hundred hours to assure electrical stability, (Gm > 3350 μmhos) and freedom from inoperatives. Tubes are operated under stability life-test conditions.

Intermittent Life Test – 500 hours. Sample is operated with minimum Envelope Temperature of 220 °C, at stability life-test conditions. 1000 hours for information.

Altitude – Sample is subjected to a pressure of 21 ± 2 mmHg (80,000 ft.) at 300 Vac to assure freedom from flashover or corona at the leads of the tube.

APPLICATION NOTES

CAUTION – – – To Electron Equipment Design Engineers. Special attention should be given to the temperature which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

NOTE A: Types CK5899 and CK6206 are the same except for suppressor grid and cathode connections. The Ec3 column in the heading applies only to type CK6206. Type CK6206 has not been designed for control or gating purposes using the No. 3 grid.

ACCEPTANCE CRITERIA

The following tests shall be performed:

For the purpose of inspection, use applicable reliable paragraphs of Specification MIL–E–1.

For miscellaneous requirements, see 3.6.

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 1)						Unit
						Min	LAL	Bogie	UAL	Max	ALD	
GENERAL												
3.1	Qualification	Required for JAN marking	---	---	---	---	---	---	---	---	---	---
3.6	Performance		---	---	---	---	---	---	---	---	---	---
QUALIFICATION INSPECTION (see note 2)												
---	Cathode	Coated unipotential	---	---	---	---	---	---	---	---	---	---
3.4.3	Base Connections	Outline E6–10	---	---	---	---	---	---	---	---	---	---
ACCEPTANCE INSPECTION, PART 1 (Production) (see note 3)												
4.7.5	Continuity and Short Tests (for reliable tubes) (inoperatives)		0.4	II	---	---	---	---	---	---	---	---
4.9.1	Mechanical production tests	Outline 8–1	---	---	---	---	---	---	---	---	---	---
4.10.4.1	Plate Current (1)		---	---	Ib	---	6.4	7.2	8.0	---	2.3	mAdc
4.10.4.1	Plate Current (1)		0.65	II	Ib	5.2	---	---	---	9.2	---	mAdc
4.10.4.3	Screen-Grid Current		0.65	II	Ic2	1.0	---	---	---	3.0	---	mAdc
4.10.6.1	Total Grid Current	Eb = Ec2 = 150 Vdc; Rk = 390; Rg1 = 1.0 Meg	0.65	II	Ic1	0	---	---	---	0.3	---	µAdc
4.10.8	Heater Current		---	---	If	---	144	150	156	---	12	mA
4.10.8	Heater Current		0.65	II	If	140	---	---	---	160	---	mA
4.10.9	Transconductance (1)		---	---	Sm	---	4200	4500	4800	---	800	µmhos
4.10.9	Transconductance (1)		0.65	II	Sm	3800	---	---	---	5200	---	µmhos
4.10.15	Heater-Cathode Leakage	Ehk = + 100 Vdc Ehk = – 100 Vdc	0.65	II	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	5.0 5.0	--- ---	µAdc µAdc
---	Suppressor	(See note 4)	0.4	II	---	---	---	---	---	---	---	---

RAYTHEON

CK5899
CK6206

SUBMINIATURE SEMI-REMOTE PENTODES

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 1)						Units
						Min	LAL	Bogie	UAL	Max	ALD	
ACCEPTANCE INSPECTION, PART 2 (Design)												
4.8	Insulation of electrodes	g1 – all p – all	2.5	I	R R	100 100	--- ---	--- ---	--- ---	--- ---	--- ---	Meg Meg
4.9.12.1	Low-pressure voltage breakdown	Pressure = 21 ± 2 mmHg; voltage = 300 Vac	6.5	(See note 5)	---	---	---	---	---	---	---	---
4.9.19.1	Low-frequency vibration (2)	F = 40 cps; G = 15; Rp = 10,000; Ck = 1,000 µf	2.5	I	Ep	---	---	---	---	60	---	mVac
4.9.20.3	Variable-frequency vibration (1)	No voltages; post shock and fatigue test end points apply	10.0	(See note 5)	---	---	---	---	---	---	---	---
4.10.3.2	Audio-frequency noise	Esig = 70 mVac; Ec2 = 19 Vdc; Rg1 = 0.1 Meg; Rg2 = 1,000; Rp = 0.2 Meg; Ck = 1,000 µf (see note 6)	2.5	I	---	---	---	---	---	---	---	---
4.10.6.2	Grid Emission	Ef = 7.5 V; Ec1 = –14 Vdc; Rg1 = 1.0 Meg; Rk = 0 (see note 7)	2.5	I	Ic1	0	---	---	---	–0.5	---	µAdc
4.10.9	Transconductance (2)	Ef = 5.7 V	2.5	I	$\Delta_{Ef}Sm$	---	---	---	---	10	---	%
4.10.9	Transconductance (3)	Ec1 = –14 Vdc; Rk = 0	2.5	I	Sm	1.0	---	25	---	75	---	µmhos
4.10.10	Plate Resistance		6.5	L6	rp	0.175	---	---	---	---	---	Meg
4.10.14	Direct Interelectrode capacitance	0.405 in. dia. shield 0.405 in. dia. shield 0.405 in. dia. shield	6.5	Code F	Cg1p Cin Cout	--- 3.5 2.9	--- --- ---	--- --- ---	--- --- ---	0.015 4.5 3.9	--- --- ---	pf pf pf
ACCEPTANCE INSPECTION, PART 3 (Degradation rate) (see note 8)												
4.9.5.3	Subminiature lead fatigue		2.5	Code F	---	4	---	---	---	---	---	arcs
4.9.20.5	Shock test	Hammer angle = 30°; Ehk = + 100 Vdc (see note 9)	---	---	---	---	---	---	---	---	---	---
4.9.20.6	Fatigue test	G = 2.5; fixed frequency; F = 25 min. 60 max.	6.5	(See note 5)	---	---	---	---	---	---	---	---
---	Post shock and fatigue test end points	Vibration (2)	---	---	Ep	---	---	---	---	200	---	mVac
		Heater-cathode leakage Ehk = + 100 Vdc Ehk = – 100 Vdc	--- ---	--- ---	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	20 20	--- ---	µAdc µAdc
		Change in transconductance (1) of individual tubes	---	---	$\Delta_t Sm$	---	---	---	---	20	---	%
4.9.6.3	Glass strain (for receiving tubes)		6.5	I	---	---	---	---	---	---	---	---

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Allowable Defectives per Characteristic		Symbol	LIMITS		Units
					First Sample	Combined Samples		Min	Max	
ACCEPTANCE INSPECTION, PART 3 (Life) (see note 8)										
4.11.7	Heater-cycling life test	Ef = 7.0 V; 1 min. on, 4 min. off; Ehk = 140 Vac; Ec1 = Ec2 = Eb = Ec3 = 0 (see note 10)	2.5	Code II	---	---	---	---	---	---
4.11.3.1(a)	Stability life test (1 hour)	Ehk = + 200 Vdc; Rg1 = 1.0 Meg; TA = room (see note 11)	1.0	Code I	---	---	---	---	---	---
4.11.4	Life test end points (stability)	Change in transconductance (1) of individual tubes	---	---	---	---	Δ_t Sm	---	10	%
4.11.3.1(b)	Survival-rate life test	Stability life test conditions, or equivalent; TA = room (see notes 12 and 13)	---	II	---	---	---	---	---	---
4.11.4	Life test end points (survival rate)	Continuity and short (Inoperatives)	0.65	---	---	---	---	---	---	---
		Transconductance (1)	1.0	---	---	---	Sm	3350	---	µmhos
4.11.5	Intermittent life-test (operation)	Stability life test conditions; T (envelope) = +220°C min (see notes 14 and 15) 1000-hour requirements do not apply	---	---	---	---	---	---	---	---
4.11.4	Life test end points (intermittent) (500 hours)	(See note 16) Inoperatives (see note 17)	---	---	1	3	---	---	---	---
		Grid current	---	---	1	3	Ic1	0	−0.8	µAdc
		Heater current	---	---	2	5	If	138	164	mA
		Change in transconductance (1) of individual tubes	---	---	1	3	Δ_t Sm	---	20	%
		Transconductance (2)	---	---	2	5	Δ_{Ef} Sm	---	15	%
		Heater-cathode leakage Ehk = + 100 Vdc	---	---	2	5	Ihk	---	10	µAdc
		Ehk = − 100 Vdc					Ihk	---	10	µAdc
		Insulation of electrodes g1 − all	---	---	2	5	R	50	---	Meg
		p − all					R	50	---	Meg
		Transconductance (1) average change	---	---	---	---	Avg Δ_t Sm	---	15	%
		Total defectives	---	---	4	8	---	---	---	---
4.11.5	Intermittent life test operation (1000 hours) (information)	Intermittent life test conditions (see notes 15, 18 and 19)	---	---	---	---	---	---	---	---
4.9.18	Container drop	(d) Package group 1; container size C								

NOTES:

Note 1. Variable sampling. See 4.1.1.7.

Note 2. All tests listed hereon shall be performed during qualification inspection; however, these two tests are normally performed during qualification inspection only.

Note 3. The AQL for the combined defectives for attributes in acceptance inspection (production) part 1, excluding inoperatives and mechanical, shall be 1 percent.

Note 4. Reject for open suppressor if plate current does not decrease by a minimum of 10 percent when Ec3 is changed from 0 to −100 Vdc. This test is applicable only to tube type CK6206.

Note 5. This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. When one lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test, until a lot passes. Standard MIL-STD-105, sample size code letter F, shall apply.

Note 6. The rejection level shall be set at the VU meter reading obtained during calibration.

Note 7. Prior to this test, tubes shall be preheated 5 minutes at conditions indicated below. Test within 3 seconds after preheating. A 3-minute test is not permitted. Grid emission shall be the last test performed on the sample selected for the grid emission test.

Ef	Ec1	Ec2	Ec3	Eb	Rk	Rg1
V	Vdc	Vdc	Vdc	Vdc	ohms	Meg
7.5	0	100	0	100	120	1.0

Note 8. Destructive tests. Tubes subjected to the following destructive tests are not to be delivered on the contract or order.

4.9.5.3 Subminiature lead fatigue
4.9.20.5 Shock
4.9.20.6 Fatigue
4.11.7 Heater-cycling life test
4.11.5 Intermittent life-test operation

Note 9. A grid resistor of 0.1 Meg shall be added; however, this resistor will not be used when a thyratron-type short indicator is employed.

Note 10. The no-load to steady-state full-load regulation of the heater-voltage supply shall be not more than 3.0 percent. This test shall be made on a lot-by-lot basis. A failure or defect shall consist of an open heater, open-cathode circuit, or heater-cathode short.

Note 11. Stability life test. The sampling and testing procedures for this test shall be as specified in 20.2.5.1 of Appendix C.

Note 12. Survival-rate life test. The sampling and testing procedures for this test shall be as specified in 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C.

Note 13. For survival-rate life test, the equivalent stability life-test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

Note 14. Intermittent life-test operation. Sampling and acceptance procedures for these tests shall be as specified in 20.2.5.3 of Appendix C.

NOTES (Cont'd.)

Note 15. Envelope temperature is defined as the highest temperature indicated when using a thermocouple of No. 40 B and S, or smaller diameter elements welded to a ring of 0.025-inch diameter phosphor bronze placed in contact with the envelope. The envelope temperature requirement will be satisfied if a tube, having bogey Ib (±5 percent) under normal conditions, is determined to operate at or above the minimum specified temperature in any socket of the life-test rack.

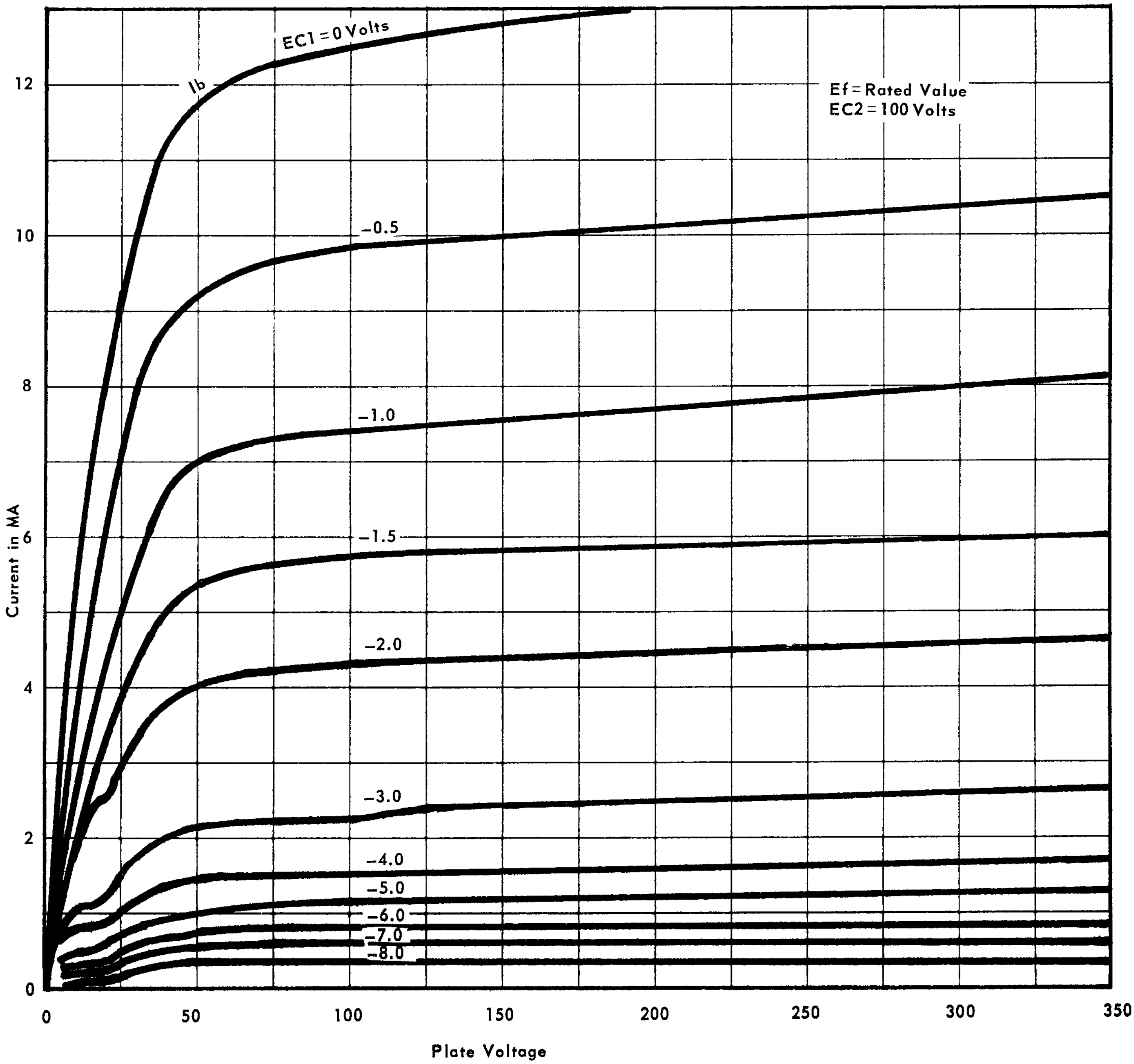
Note 16. Order for evaluation of life-test defects. See 4.11.3.1.2.

Note 17. An inoperative as referenced in life test is defined as a tube having one or more of the following defects: discontinuity (see 4.7.1), permanent shorts (see 4.7.2), air leaks (see 4.7.6).

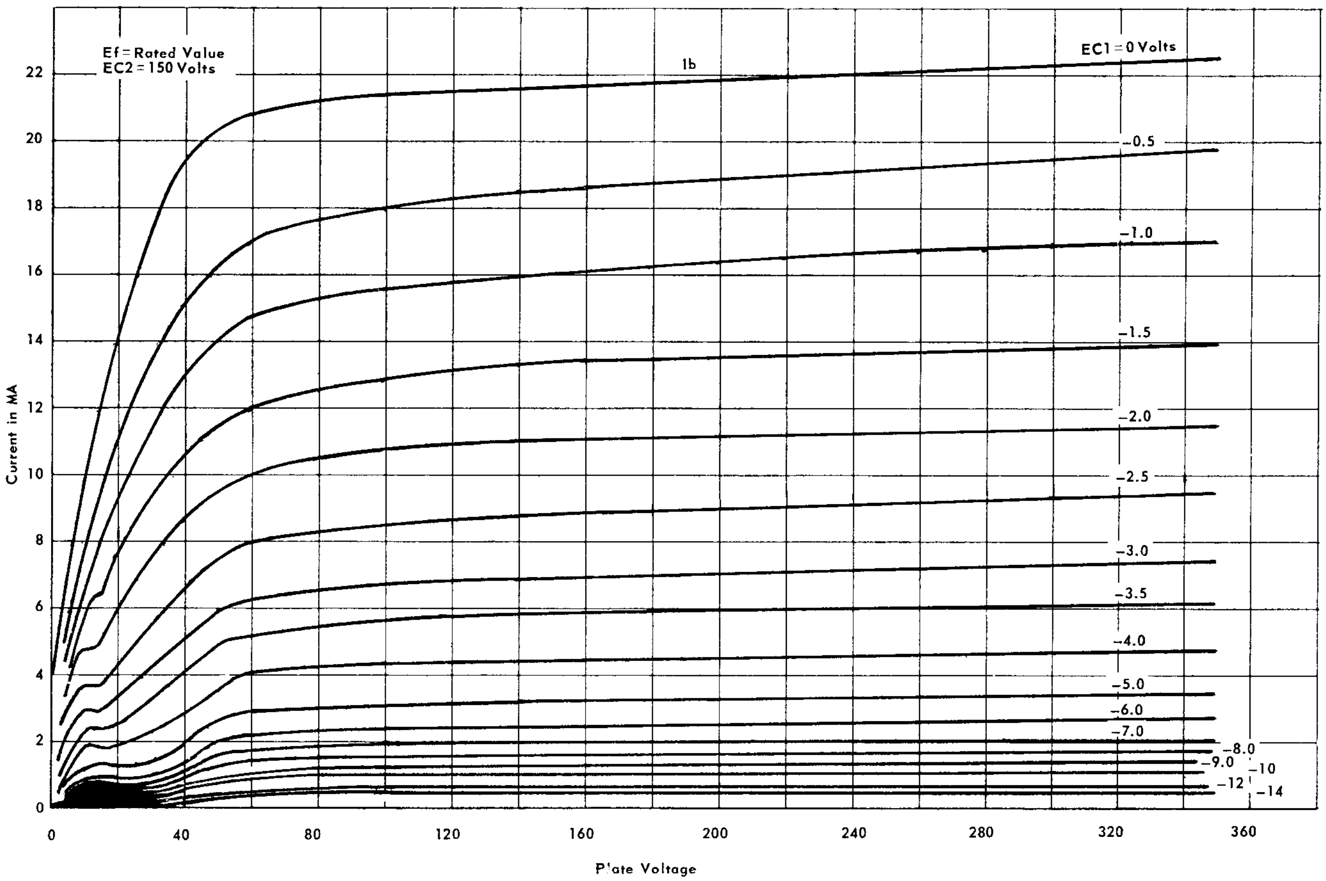
Note 18. On information life tests, read same characteristics as for intermittent life test. Limits do not apply. Six copies of this data shall be forwarded to the Armed Services Electro-Standards Agency for distribution and file.

Note 19. This life test shall be conducted on a minimum of one sample of 10 tubes each month of production. This sample shall be selected as the first 10 serially marked, noninoperative tubes from a completed intermittent life-test sample. This life test shall be classified as a destructive test. Read at 1,000 hours.

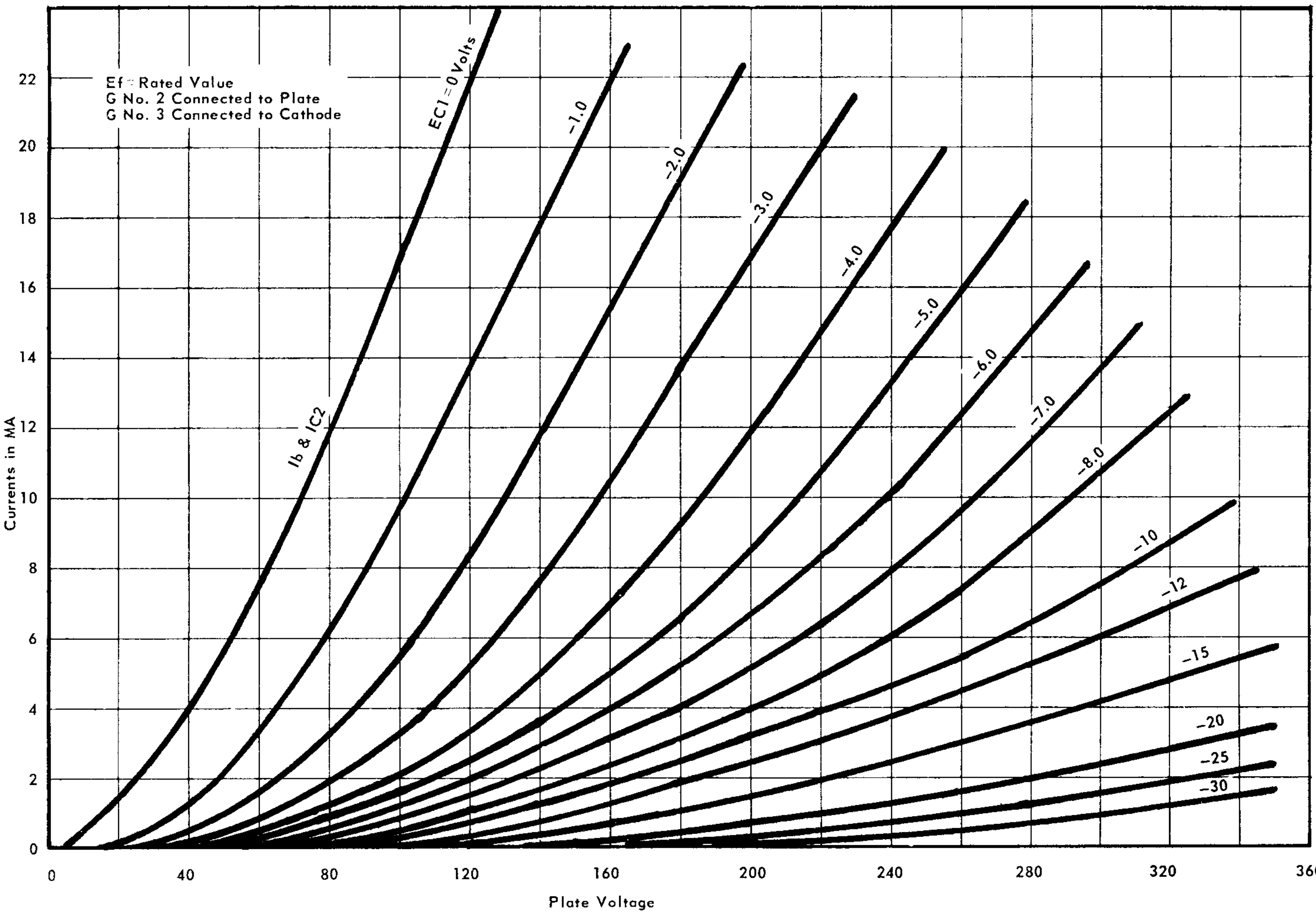
AVERAGE PLATE CHARACTERISTICS
(Pentode Connected)



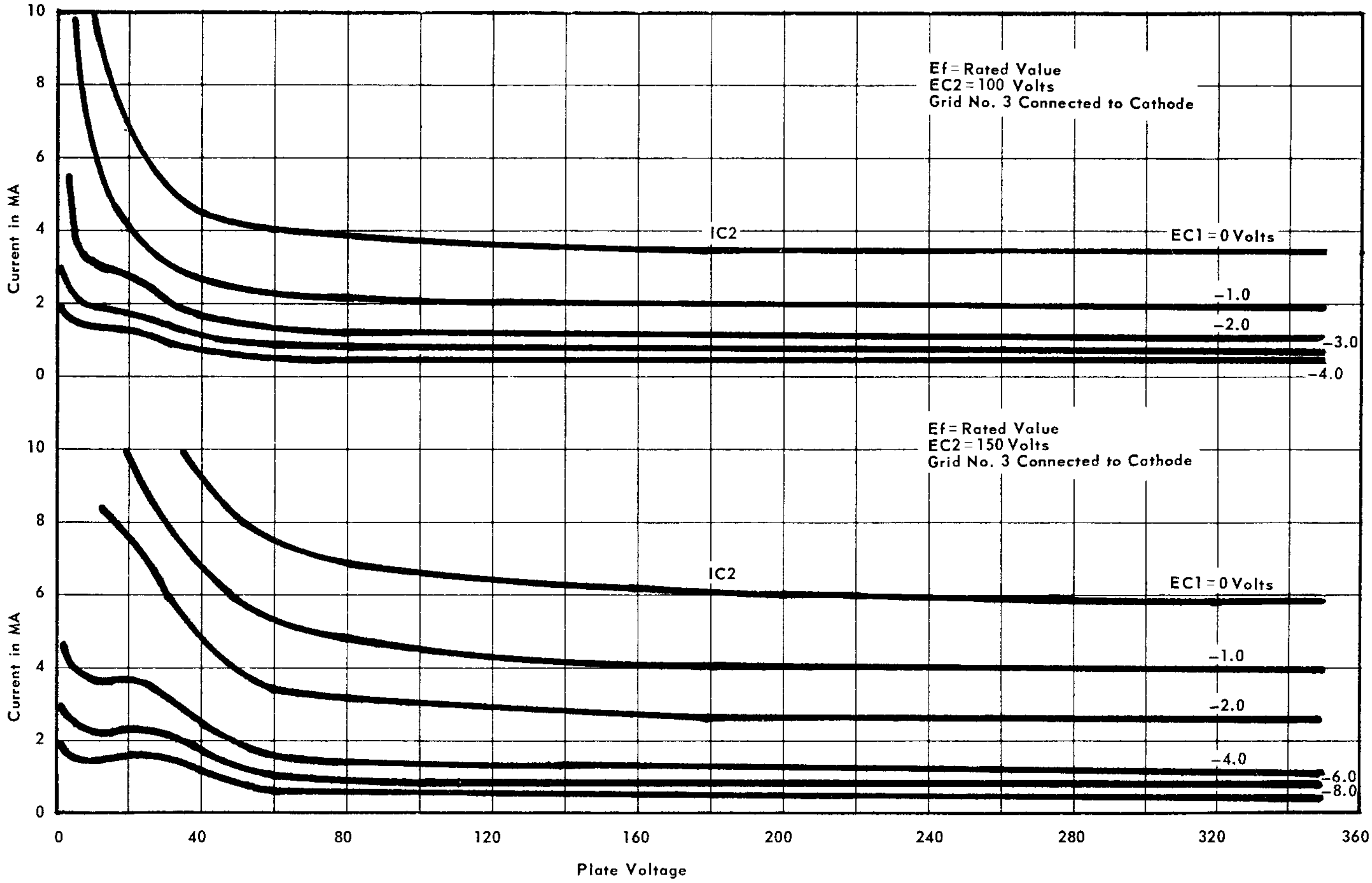
AVERAGE PLATE CHARACTERISTICS
(Pentode Connected)



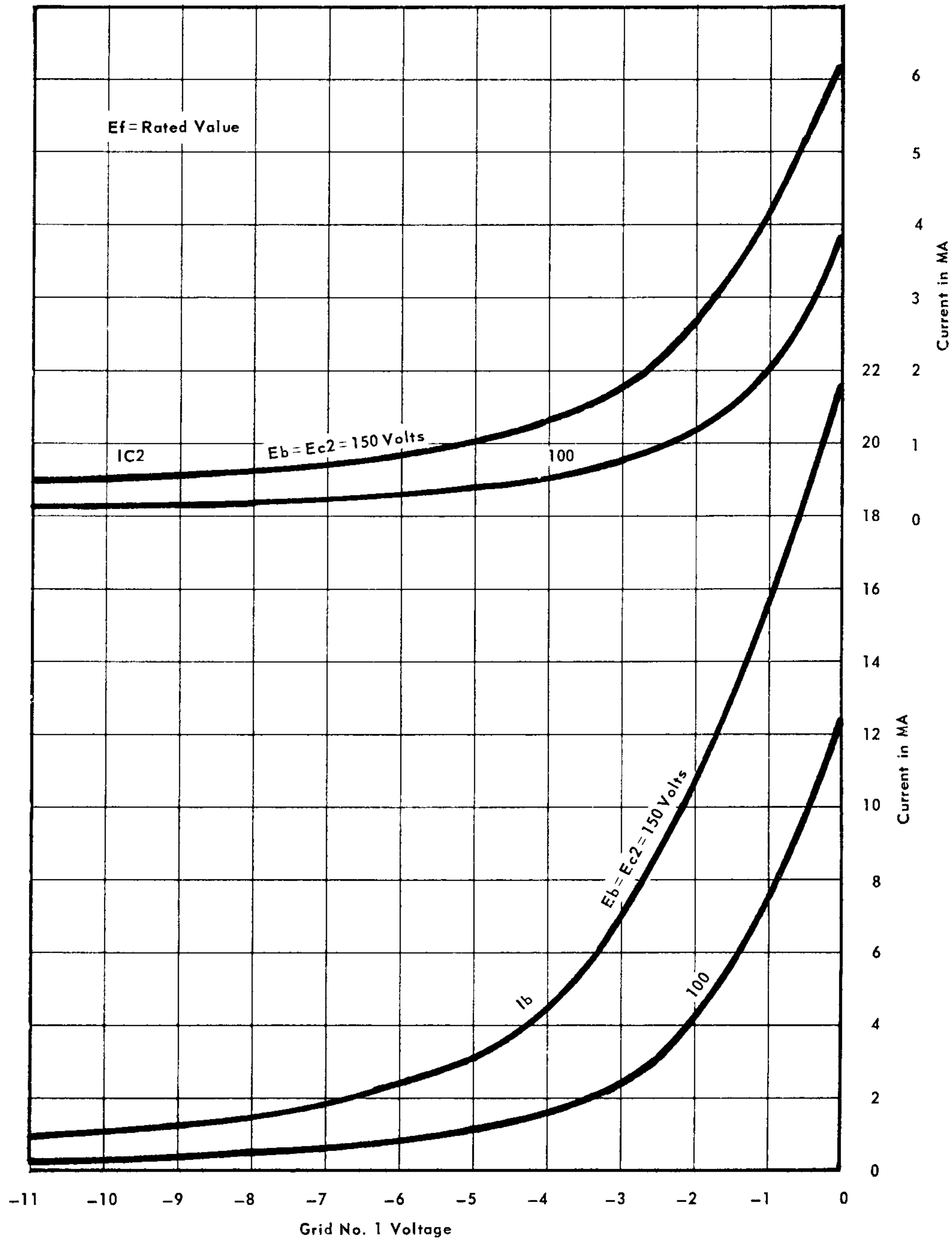
AVERAGE PLATE CHARACTERISTICS
(Triode Connected)



AVERAGE GRID NO. 2 CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS
(Pentode Connected)



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AVERAGE TRANSFER CHARACTERISTICS
(Pentode Connected)

